## Factorising – Junior Cert Ordinary Level

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### Highest Common Factor

**Step 1: Find the HCF**

(this is the biggest number and letter which is common to both terms)

| $3x^2 + 6x$                   |
| (HCF = $3x$)                  |

**Step 2: Put the HCF outside the brackets**

| $3x^2 + 6x$                   |
| $= 3x(\quad)$                |

**Step 3: Divide each term by the HCF to find the factor inside the brackets**

(What do I need to multiply by the HCF to get the first term? What do I need to multiply by the HCF to get the second term?)

| $3x^2 + 6x$                   |
| $= 3x(x + 2)$                |

### Grouping

**Step 1: Separate the 4 terms into 2 pairs which have a common factor**

(this is usually done for you)

| $3ac + 6c + ad + 2d$         |

**Step 2: Do HCF for each pair (see above)**

(take out the common factor of each 2 terms)

| $3ac + 6c + ad + 2d$         |
| $= 3c(a + 2) + d(a + 2)$     |

These brackets should be the same!

**Step 3: Don’t forget to put this into “Double Brackets”**

(This is actually like a giant HCF)

(Put the two HCFs from the previous step into one bracket, and the second bracket is the one which was the same from the last step)

| $3c(a + 2) + d(a + 2)$       |
| $(3c + d)(a + 2)$            |
# Quadratics – Trial and Error method

**Step 1:** Write down the question, and two empty brackets underneath

\[ x^2 + 5x - 24 \]

\[( \quad )( \quad )\]

**Step 2:** Fill in the \( x \) and \( x \) as the first terms in the brackets  
*because these will multiply together to give us the \( x^2 \) term*

\[ x^2 + 5x - 24 \]

\[( x \quad )(x \quad )\]

**Step 3:** We now need to think of two numbers that will multiply to make the last term.  
*Hint: if this is a + then both signs in the brackets will be the same. If it's a – sign then the signs will be different.*

Let's try –6 and 4

\[ (x - 6)(x + 4) \]

**Step 4:** Multiply out the brackets (F.O.I.L.) Do the Outer and Inner terms add together to make the middle term of the original expression?

\[ x^2 + 5x - 24 \]

\[ (x - 6)(x + 4) \]

\[ x^2 + 4x - 6x - 24 \]

Is \( 4x - 6x = 5x \)?

NO! So - try again.

\[ x^2 + 5x - 24 \]

\[ (x + 8)(x - 3) \]

**Step 5:** Repeat steps 3 and 4 until you find 2 numbers that work!

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# DOTS (Difference of 2 Squares)

**Step 1:** Re-write the question as \((Something)^2 - (Something else)^2\)

\[ x^2 - 36 \]

\[ = (x)^2 - (6)^2 \]

**Step 2:** Use the rule \( a^2 - b^2 = (a + b)(a - b) \)

In words, this is \((First + Second)(First - Second)\)

\[ x^2 - 36 \]

\[ = (x + 6)(x - 6) \]
### Factorising Quadratics

**Method: Trial and Error**

**Factorise:** Put it into brackets.

**Step 1:** Write down the quadratic expression.

**Step 2:** Draw the brackets and order them.

**Step 3:** Write down the 2 terms (usually just x and x^2) that multiply to make the x^2 term of the quadratic.

**Step 4:** Think of 2 numbers that multiply to make the last term of the quadratic.

**Step 5:** Work out the signs (for the last term). Remember:

- **Signs Same:** + x + or - x -
- **Signs Different:** + x - or - x +

**Step 6:** Multiply out the brackets to check.

If you have the right answer, if you don’t, go back to step 2.

**Step 7:** If you have the right answer, remember...

The brackets are the answer... not the checking...

**Example:**

eq. \( x^2 - 3x - 10 \)

1. 5 and 2, because 5 \( \times \) 2 = 10.
2. \((x - 5)(x + 2)\)
3. In this case, \( x \times x = x^2 \)
4. In this case, try 5 and 2.

**ANS:** \((x - 5)(x + 2)\)
**Quadratic Equations (Equations with an \(x^2\))**

**Steps:**
1. Make sure equation has an \(a = 0\).
2. Factorise.
3. Write down answers / solve.

**Example:**

\[x^2 + 8x + 12 = 0\]

\[(x + 6)(x + 2) = 0\]

\[x = -6 \quad \text{or} \quad x = -2\]

This can be learnt as a rule:

**Example:**

\[x^2 - 9x + 14 = 0\]

\[(x - 7)(x - 2) = 0\]

**(x-7)** is a number

**(x-2)** is a number.

When I multiply two numbers together to make zero,

Either the first number or the second number has to be \(0\).

So, in this example,

Either \((x - 7)(x - 2) = 0\)

\[x = 7\]

\[x = 2\]